Report for 2003WA41B: Water Use of Potato under Sprinkler and Subsurface Drip Irrigation

There are no reported publications resulting from this project.

Report Follows

Problem and Research Objectives

Irrigation is essential for high yields and net returns for a myriad of crops in the PNW, particularly for potato. But overhead (sprinkler) irrigation applied intensively on the coarse soils of the Columbia Basin may have negative impacts on both water quality and water availability. Potato rotational crops are typically grown on soils low in organic matter content that are highly susceptible to agri-chemical leaching under poor irrigation scheduling. Groundwater protection from nitrate (NO_3-N) contamination is an important public concern and a major environmental issue in this region and other parts of the nation. Overall, in Washington, 23% of the 574 wells sampled contained NO_3-N concentrations in excess of the EPA's maximum contaminant level (Ryker and Fran, 1999). Water availability is also a concern in the PNW. According to the Washington State Department of Ecology, 2001 was the second driest year on record leading to the declaration of a statewide drought emergency on March 14th, 2001. Although the situation improved during the last couple of years, water availability for irrigation continues to be a major concern in the State of Washington.

Drip irrigation offers the potential for significant water savings and reduced impact on surface and groundwater quality through more efficient delivery of water and chemicals. A better understanding and quantification of these potential benefits are an important step towards the adoption of drip irrigation by the potato industry.

The main objective of this research project was to compare potato irrigation under sprinkler and subsurface drip irrigation. We believe that a better understanding of potato water use under drip will help establish drip irrigation as a viable commercial option for potato production in the PNW. Drip irrigation and associated management strategies will promote protection of surface water and groundwater quantity and quality in the Pacific Northwest

Methodology

Field studies were located at the USDA-ARS Paterson, WA research site on a Quincy loamy sand (mixed mesic Xeric Torripsamments) soil. Sprinkler and drip irrigation plots were established in an area of approximately 2 acres. Each sprinkler plot consisted 6 80 feet long rows 34" apart. Each drip plot consisted of 3 double beds according to the design shown in Figures 1 and 2.

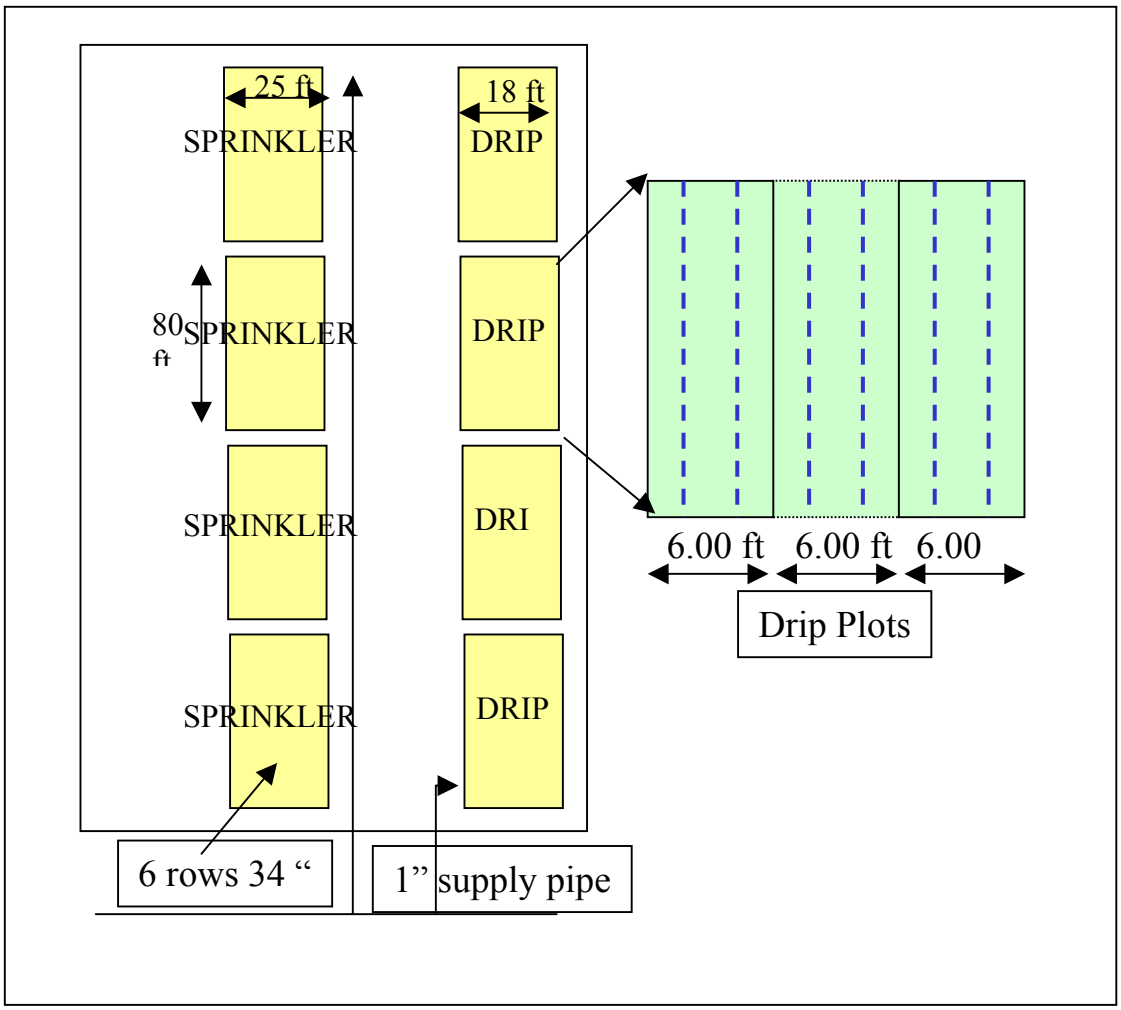

Figure 1. Drip and sprinkler plots layout.

Sprinkler plots were irrigated by a solid set system consisting of 55 Nelson R10 Turbo 9° (blue plate) white nozzle size (#70) with pressure regulators. Drip lines were TSX 500 6 mil, 12 in spacing and flow rate of 0.22gpm / 100ft. One potato variety, Ranger Russet was planted in all plots. Soil water content was monitored in all plots using Campbell Scientific CS616 TDR sensors and irrigation was automated to start and stop according to preset thresholds established by the investigators.

Figure 2. Planting of drip irrigation potato plots, May 1st, 2003.

Figure 3. Installation of subsurface drip lines.

Figure 4. Drip (top) and sprinkler (bottom) plots.

Principal Findings and Significance

Initial results obtained during the 2003 cropping season indicated a number of important conclusions. First and foremost, drip irrigation in a very sandy soil such as the one found in the area where the research was conducted requires special attention. The fact that no pre-planting irrigation was applied to the research plots due to the fact that drip tapes can only be installed after planting, combined with the fact that drip lines were installed between rows resulted in initial water stress to the crop. The narrow wet bulb created around drip outlets resulted in under irrigation of young potato plants. Figure 5 demonstrates the fact that irrigation wasn't fully effective since only the inner part of the rows were reaching the wet bulb created around the drip tape.

Figure 5. Drip irrigated plots showing wet zone created by subsurface drip lines.

Sprinkler irrigation plots had excellent development throughout the season resulting in above average yields. It should be noticed that solid set systems are not typical in the region, most sprinkler irrigation systems are center pivots. Initial plans requested the use of a linear system for the sprinkler irrigation component of this research. However, operational constraints where the linear system is currently installed caused the experiment to be conducted in the USDA-ARS research site.